

Rapid Access Disks Utility Programs for the SDS 930 Computer

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This article describes three utility programs for the SDS 930 computer with rapid access disks (RADs). Two of these programs transfer data between magnetic tape and an RAD, and the third is a diagnostic program. All programs operate in a multitasking environment using MULTI, a small 930 operating system.

I. Introduction

A pair of programs has been written for the SDS 930 computer to supplement the data transfer program MEDIA. It allows rapid access disks (RADs) to magnetic tape to RAD transfers of data. Using these programs, one can selectively save the contents of an RAD in a sector-by-sector tape dump. All or part of the RAD or tape file can be transferred.

A simple RAD diagnostic was also written. It uses the 930 multiprogramming task master MULTI (Ref. 1) to perform a read-write-verify test on selected portions of the RAD. It was written to provide our section with an easy to understand diagnostic that can be easily changed as conditions necessitate, and also as a checkout for the 930 version of MULTI. The program is designed to run for long periods of time, and will provide an error summary as output.

II. User's Guide for RAD Diagnostic

There are two parameters necessary to run this program: the range of RAD addresses to test, and the test pattern to use. The addresses are selected by using the RAD's file protection switches. Only those sectors which are not protected will be tested. The pattern to be used is entered on the display and entry panel (DEP) thumbwheel switches (Ref. 2). It is copied into a 64-word buffer, which is written onto the RAD sectors. Another buffer is filled with the ones complement of the buffer just written, and the sector is read back in. The two buffers are then compared word by word, and errors are tabulated by the band number, sector within a band, and word within a sector. To obtain a listing of all errors without stopping the program, the console interrupt button is pressed. A listing of the errors is written on the line printer while the diagnostic continues.

III. User's Guide to RADTAPE

RADTAPE transfers contiguous sectors from a 930 RAD to magnetic tape. The RAD sectors are dumped in separate records containing sixty-five 24-bit words (the extra word contains the RAD address). The program uses the third version of the multiprogramming task master MULTI to overlap input and output functions.

Multiple buffering allows tasking to overlap tape and input/output (I/O) operations. When no other tasks are active, a task is run which allows core locations to be displayed on the DEP device attached to the 930. Sense lights on this panel are also used, with one of ten lights being lit whenever a given task or interrupt routine is being executed. This turned out to be very valuable while debugging the program.

The program begins by typing the prompt

ENTER TAPE UNIT AND NUMBER OF
FILES TO SKIP

The user types the logical tape unit selected, and a decimal number of files to skip (zero is acceptable; negative numbers are not acceptable). If the tape is write-protected, new numbers must be entered and the prompt will be repeated. After these values are read, the prompt

ENTER RANGE OF ADDRESSES TO DUMP
(IN OCTAL)

appears. The user gives a range of octal RAD sector addresses to dump. Two addresses must be entered, and the first address must be less than or equal to the second address. If not, the prompt is repeated and another pair of addresses must be entered.

When typing in the addresses, the backspace character will delete the previous digit of the current number being typed. To delete the entire line, the delete character (⌫) is typed. This causes a carriage return and a line feed to be echoed. The following characters serve as separators of numbers:

blank
comma
dash
carriage return

More than one number can be entered on a line. For example, the following lines are equivalent:

0,5
0-5
0 5

RADTAPE writes a double end of file after each block of contiguous sectors is written, but back spaces over the second end of file (EOF) after it is written. After this is done, the prompt

ENTER RANGE OF ADDRESSES TO DUMP
(IN OCTAL)

is repeated, and another set of RAD sectors can be dumped. By repositioning the tape in front of the second EOF, single EOF marks will separate blocks of sectors, while the last block is followed by a double EOF. The program is stopped by changing the RUN-IDLE-STEP switch to IDLE, and booting in the system from the RAD.

In case of an error detected by the tape controller while writing, the program attempts to rewrite the record three times before erasing that section of the tape and trying again farther down the tape. Instead of backspacing over the record in error, the program skips backward to the previous EOF mark (or bottom of text (BOT) mark) and skips forward over the records previously written. This avoids a problem that can occur when the tape drives are not perfectly tuned. They might then erroneously move back into the previous record while backspacing or erasing reverse, destroying part of the previous record.

Errors detected by the RAD controller or Y channel cause the message

****RAD ERROR****

to be typed, and the program halts.

IV. User's Guide to TAPERAD

TAPERAD transfers sectors previously stored on magnetic tape by the program RADTAPE to the RAD, using the multiprogramming taskmaster MULTI (Ref. 1). The files stored on tape are blocks with contiguous RAD sector addresses, each record containing 65 words. Multiple buffers allow the use of tasks to overlap the input and output operations. As in RADTAPE, a background task is run which continuously displays a location in memory, and the sense lights are used to indicate active tasks.

The program begins by typing the prompt

ENTER TAPE UNIT

The user types the logical tape unit selected, and the program continues by typing

ENTER NUMBER OF FILES TO SKIP, NUMBER TO PROCESS

A decimal number is entered for each item, and the number to process must be nonzero. If not, the prompt is repeated, and both numbers must be reentered. The second number is used when the user wants to dump several blocks which are on adjacent files:

ENTER RANGE OF ADDRESSES TO DUMP (IN OCTAL)

The user gives the acceptable upper and lower bounds for sector addresses to be transferred. Entering 0-17777 will dump all records in the number of files specified. If the first address is greater than the second address, the prompt is repeated and the numbers must be reentered.

The program now begins skipping any files requested and then transferring any records in the range given above. Three errors can occur:

****RAD IS FILE PROTECTED. TOGGLE BPT 4 TO RETRY****

The program then loops until the position of BPT 4 is changed, and will try to write the sector again:

****RAD ERROR****

This is typed when a Y channel error occurs, or the coupler signals an error. The program halts.

ENTER 0 TO RETRY, 1 TO USE IT, 2 TO SKIP IT

This is typed when a tape error is signalled. TAPERAD tries to read each record at most five times; then it prints the above message and waits for the operator to type a response. 0 causes five more tries, 1 accepts the record as last read, and 2 causes the record to be ignored.

The programs RADTAPE and TAPERAD can be used in lieu of SYSGEN, by saving the system, its libraries, and the disk directory. This would be done by writing two files: one from 0 to the last address used by the libraries, and another block to get the directory at the other end of the RAD. To restore the system, the user would process two files, giving the range 0-17777 of addresses to dump.

When finished processing the given number of files, the program is ready to continue, and again asks for the number of files to skip to and process. The program is terminated by moving the RUN-IDLE-STEP to IDLE, and booting in the system from the RAD.

References

1. Erickson, D. E., and Layland, J. W., "An Experiment in Remote Monitoring of Mu-Ranging Operation at Mariner Mars 1971 Superior Conjunction," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. XV, pp. 156-166, Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1973.
2. Brokl, S. S., "Computer Display and Entry Panel," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. IX, pp. 44-48, Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1972.